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A FEW SUGGESTIONS ON THE TEACHING OF BOTANY AS A NATURE STUDY.

BY C. AGNES ROOPER.

AT this present time, it has become the creed of all educationists that the study of nature holds a very important place in the training of the young, and why it should be so is not far to seek, for this study is only another expression for actual and individual observation of nature, leading to a familiar acquaintance with her ways, her qualities, her adaptations, as well as to her absolute facts. The advantages of this knowledge thus gained, are the widening of the thoughts, conceptions, and ideas of the young students, the arousing of their tenderest emotions, and the gift of a sympathy with all living organisms. To create a real desire for this knowledge, which is the only truly successful method to impart it, is perhaps in many cases not an easy task. It seems to me, however, it may be done and that in a pleasant way to both teacher and pupil. Children are naturally inquisitive, and therefore the method I should suggest would be one which would awaken their curiosity. Let me specialise this with regard to botany, a subject which, by the way, finds greater favour as a rule with girls than boys. The general way of teaching botany is to give the children the knowledge of the names of flowers, to show them how to distinguish one from another, and to encourage them to make collections of dried flowers. All this knowledge is valuable as far as it goes, but it only teaches the young botanists to know *about* flowers, it does not teach them really to know them.

To make the study truly interesting more must be done. An acquaintance must be made with their respective characters, habits, manner of growth, and their wonderful adaptations to environment. Much of this may be learnt by properly directed observation in the open, during walks or else in the garden. Two or three special plants may be taken and carefully watched and observed from the time the seed is

put in the soil, until their respective annual courses are run, and they either go to their winter's rest or die, their life's work having been accomplished during the season. But there is an additional way which affords interest and amusement, both to teacher and pupil, and that is by various simple experiments to prove the facts taught about plants in the text books. For instance the following is a biography of an oak tree. Go to any wood in the Autumn, where the wood-cutters have been at work, choose a tree which has been felled and is lying on the ground, observe that part of the trunk which has been sawn through, and you will see a central point with rings arranged round it, more or less regularly, count these rings for they will show you the age of the tree, and how they do is as follows. Near to the bark of this and all trees, there is a living active circle, called the cambium layer, from this layer, which is developed when the tree is still quite young, a small zone arises every year until the tree dies, consisting of a layer of wood internally, and a layer of bark externally, in such a way that the oldest layers are always pushed back by the new ones to the centre of the tree. New wood is made in the Spring and in the Autumn, which differ in some respects and it is by this difference that the age of the tree can be accurately known. The age of the tree having thus been determined, the next thing to observe is that all the layers are not of the same thickness. Some are thin, some are thick. The thin ones correspond to those years which have been exceptionally dry, or to a very fruitful year when much of the sap has gone to make the fruit instead of making wood. The thick circles point to wet seasons, favourable to vegetable growth. Then, probably some of the circles are brown and powdery, as if they were rotten, these are the result of very severe and cold winters, for the wood being formed on the outside and therefore exposed, perished from the cold and was subsequently covered by other layers of good wood in due course. Again, some of these layers are not alike all round, but are thick on one side and thin on the other, which shows that the tree has been partially checked in its growth and development, either by some obstacles to the proper formation of all its roots, or to the too close proximity of some other tree.

To prove the influence of light on the stems of trees, this experiment is of use. A little observation shows that most plants grow towards the light, a bush planted against a wall develops its branches away from it, and the flowers of plants in a room will always turn towards the windows. Take a young rose plant, or any plant with supple branches, growing in a pot, set it in a place near some strong light which shines on it from one side only, whilst the other is in shade. Then fix between it and the light a thick piece of cardboard big enough to keep the light away from it, make a hole in the cardboard about an inch in diameter, just opposite one of the branches, this branch will soon grow through the hole, and turn vertically upright. When this branch has grown to a certain height, turn the plant and cardboard round so that the plant is in the light and the cardboard on the shaded side, the branch is now in the shade. Cut another hole above the first, and the branch in its desire for light will soon make its way through it. This process may be carried on for several days in succession, one hole above another, so that the branch is forced to grow in a zig-zag direction on the two sides of the cardboard.

It is a well-known fact that plants live by the moisture they take out of the soil on which they grow, by their roots. This water passes up through the stem into the leaves, where, through the influence of air and light, it becomes changed into that nourishing fluid generally known as sap. This sap spreads itself over all living parts of the plant, but some of it, after its downward journey through the outer part of the stem, passes out of the roots again into the soil. This sap is now full of an acid principle, and this may be shown in the following way: take a plaque of marble, cover it with a thin layer of sand in which some haricot bean seeds are to be sown, put the plaque in some shallow pan, such as gardeners use for seedlings. Water the seeds every day, and the seeds will soon germinate and cover the plaque with young plants. In a short time, from want of proper soil, the plants will wither, then take away the sand with the plants from the plaque, and on the marble surface will be found a delicate network of furrows traced by the crossing and intercrossing of the roots, evidently not caused by pressure, but by the acid which has come out of them, in the sap.

It is a very interesting study to watch the growth of plants in a simple way, for this purpose take a damp sponge, set it in a glass jar, and sow in its holes a mixture of any kinds of hardy seeds, in a brief space of time a pretty green garden will be the result, although a short lived one, for the soil on which the plants grow does not contain the proper nourishment.

Many plants contain essential oils, either in the skins of their fruits, as in the orange, or in their seeds, as the almond, or else in the form of essences as in the petals of the rose, the heliotrope, and the lily of the valley, or in the hairs which cover their stems and leaves, as in the mint, the thyme, the sage. To prove the presence of this essential oil in the orange or the lemon, take a piece of the peel, press it between the fingers at a little distance from the flame of a candle, when a few drops will squirt out and produce a slight explosion, accompanied with a faint noise in the flame, a sort of miniature firework. In order to show the action of light on the coloration of fruits and flowers, take a rosy-cheeked apple of a good size, before it is ripe, and gum upon it any letters, cut out in paper and gum them upon it, when the apple is ripe remove the letters and they will be seen marked out in white on the otherwise rosy skin. Sow two bean seeds respectively in two pots, at the same time, and grow the one in a dark cupboard, and the other in sunlight, and observe the differences.

I have ventured to describe these few experiments merely as a suggestion of what may be carried out on a wider scale, because, I believe by doing so, an additional and valuable interest will be given to the study, an interest which will not flag, but be a source of pleasure and of far extended knowledge during a life-time.